

DOCUMENT-IDENTIFIER: US 6100190 A

TITLE: Method of fabricating semiconductor device, and semiconductor device

DEPR:

In this connection, in the above example, a PZT thin film is formed by means of sputtering. However, a dielectric film may be formed by means of implanting ions to a metal film or oxidizing a surface of the metal film, and the thus formed dielectric film may be used as a dielectric film of the capacitor. In the case that as a dielectric film of a capacitor, Ferro-dielectric film is used, an appropriate film such as IrO.sub.2 can be interposed preferably between the lower or upper electrode and the dielectric film, in order to improve orientation of the Ferro-dielectric film.

DOCUMENT-IDENTIFIER: US 5569614 A

TITLE: Method of forming metal pattern including a schottky diode

BSPR:

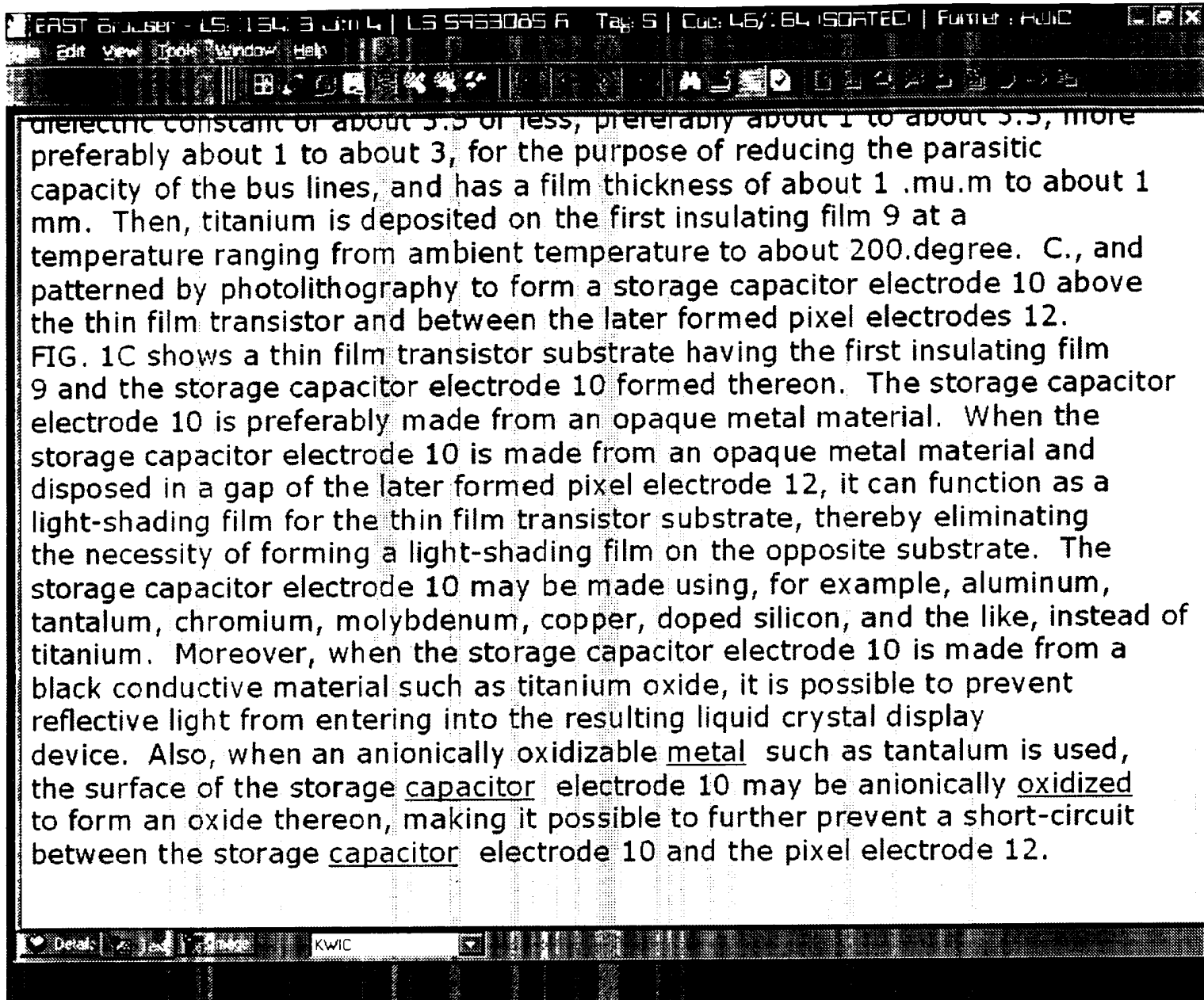
Therefore, a metal thin film, the width of which is 0.1  $\mu\text{m}$  or narrower, is deposited to be made the lower electrode of the capacitor, the metal thin film is oxidized or an insulating film is deposited so that a dielectric film is formed, and an upper electrode is formed so that a capacitor finer than the conventional capacitor can be formed.

DOCUMENT-IDENTIFIER: US 6303426 B1

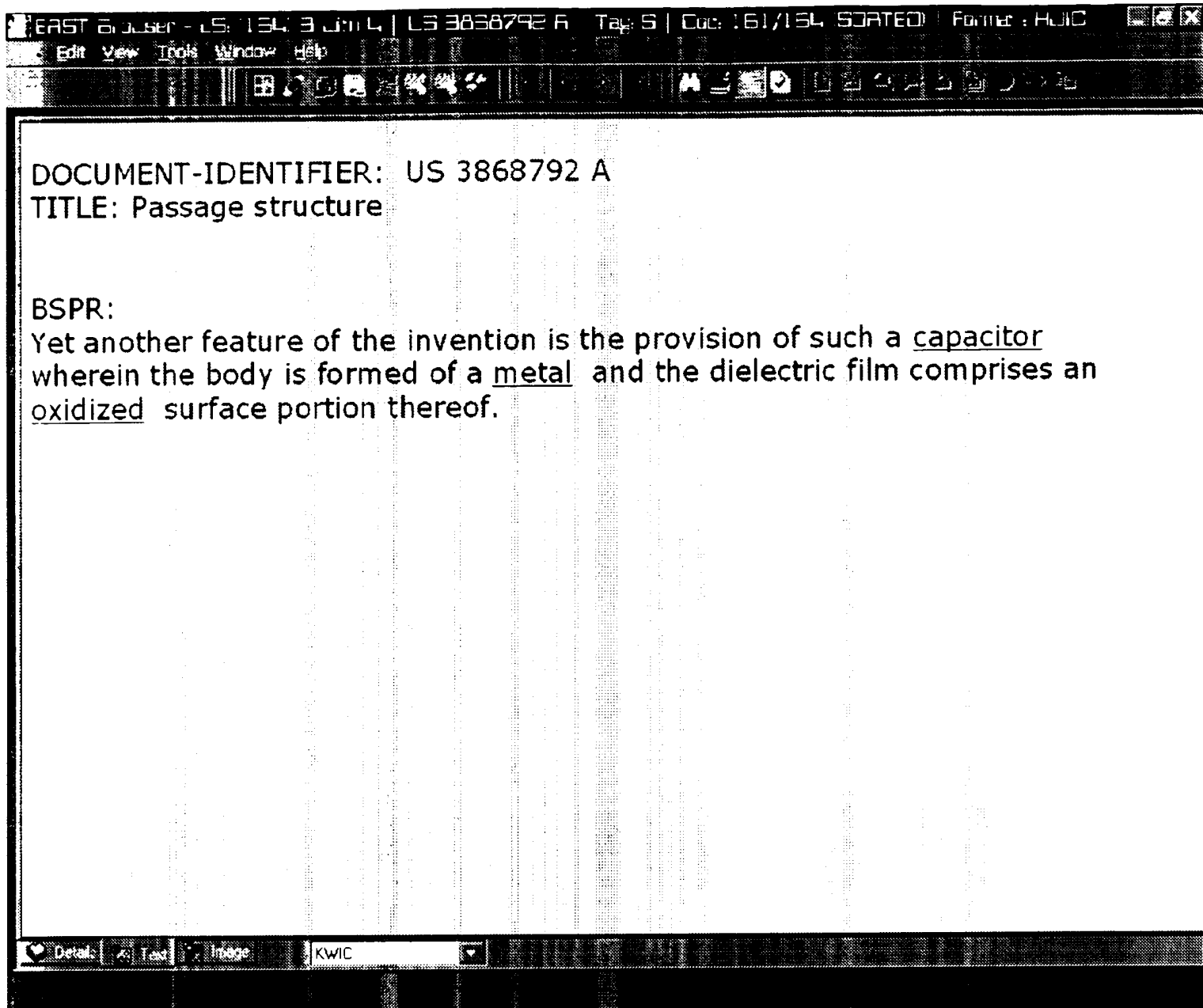
TITLE: Method of forming a capacitor having a tungsten bottom electrode in a semiconductor wafer

BSPR:

In forming a capacitor having a tungsten bottom electrode, chemical vapor deposition (CVD) is typically used to deposit a metal oxide film such as tantalum oxide or titanium oxide to form the capacitor dielectric over the bottom electrode. However, in forming the bottom electrode, a seed material such as titanium nitride is used to grow the tungsten bottom electrode and consequently, that seed material forms a thin layer on the outer surface of the formed tungsten bottom electrode. That thin layer will react with the metal oxide during the formation of the capacitor dielectric and cause the surface of the bottom electrode to oxidize, which results in leakage current problems between the electrode and dielectric. Oxidation of tungsten electrodes also produces oxides that are volatile and lead to adhesion problems.



dielectric constant of about 3.5 or less, preferably about 1 to about 3.5, more preferably about 1 to about 3, for the purpose of reducing the parasitic capacity of the bus lines, and has a film thickness of about 1  $\mu\text{m}$  to about 1 mm. Then, titanium is deposited on the first insulating film 9 at a temperature ranging from ambient temperature to about 200.degree. C., and patterned by photolithography to form a storage capacitor electrode 10 above the thin film transistor and between the later formed pixel electrodes 12. FIG. 1C shows a thin film transistor substrate having the first insulating film 9 and the storage capacitor electrode 10 formed thereon. The storage capacitor electrode 10 is preferably made from an opaque metal material. When the storage capacitor electrode 10 is made from an opaque metal material and disposed in a gap of the later formed pixel electrode 12, it can function as a light-shading film for the thin film transistor substrate, thereby eliminating the necessity of forming a light-shading film on the opposite substrate. The storage capacitor electrode 10 may be made using, for example, aluminum, tantalum, chromium, molybdenum, copper, doped silicon, and the like, instead of titanium. Moreover, when the storage capacitor electrode 10 is made from a black conductive material such as titanium oxide, it is possible to prevent reflective light from entering into the resulting liquid crystal display device. Also, when an anionically oxidizable metal such as tantalum is used, the surface of the storage capacitor electrode 10 may be anionically oxidized to form an oxide thereon, making it possible to further prevent a short-circuit between the storage capacitor electrode 10 and the pixel electrode 12.



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